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(54) **LIGHTWEIGHT YOKE FOR RAILWAY COUPLING**

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B61G 9/22 (2006.01)

(52) **U.S. Cl.**
CPC ***B61G 9/22*** (2013.01)

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CPC B61G 7/00; B61G 7/10; B61G 7/12; B61G 9/00; B61G 9/04; B61G 9/20; B61G 9/22
USPC ..... 213/40 R, 47, 62 R, 67 R, 68, 69
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2,088,135	A	7/1937	Johnson et al.	
4,024,958	A	5/1977	Kaufhold	
4,081,082	A	3/1978	Scherrer et al.	
4,206,849	A	6/1980	Kaim	
4,537,304	A	8/1985	Kaim et al.	
4,605,133	A	8/1986	Altherr	
5,096,076	A *	3/1992	Elliott	B61G 9/20 213/67 A

(Continued)

OTHER PUBLICATIONS

Brandenberg, Kristin; "Successfully Machining Austempered Ductile Iron (ADI)"; Applied Process Inc. Technologies Div.—Livonia, Michigan, USA; Oct. 2001.

(Continued)

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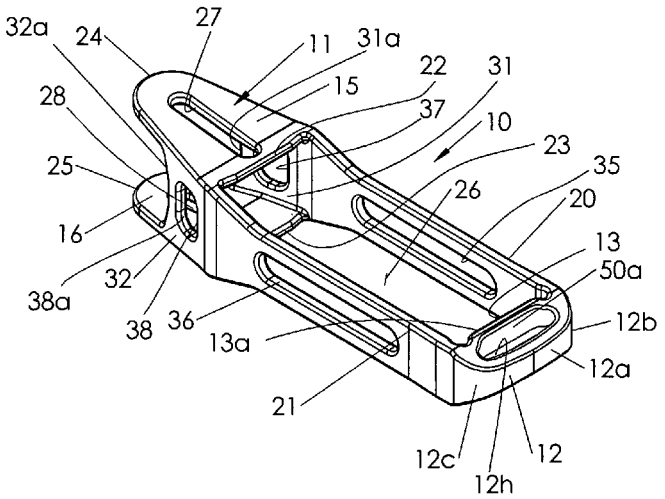
(57) **ABSTRACT**

E-type and F-type yokes improve the ability of the yokes to be constructed having lighter weight yet function to handle loads from car coupling assembly components, such as, for example, a coupler mounted on the yoke. The E-type and F-type yokes have straps and openings provided in the straps, and are constructed from austempered ductile iron. Embodiments may be constructed with a tail or butt portion that includes sloped walls that form cavities in the butt portion of the yoke, where a supporting structure spans between the yoke rear wall and the draft gear seat wall.

27 Claims, 4 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

5,320,229	A *	6/1994	Mautino	B61G 9/20 213/67 A
5,511,676	A *	4/1996	Holmes	B61G 9/20 213/67 A
5,582,307	A	12/1996	Hawthorne et al.	
5,878,897	A *	3/1999	Lazzaro	B61G 3/06 213/139
5,900,082	A	5/1999	Hewitt	
6,796,448	B1	9/2004	Wilt et al.	
7,926,672	B2 *	4/2011	Ely	B61G 9/22 213/67 R
8,607,998	B2	12/2013	McMillen et al.	
2012/0248053	A1 *	10/2012	McMillen	B61G 9/20 213/67 R

OTHER PUBLICATIONS

A. Kahn and B.K. Chen, "Evaluation of Grade 1 Austempered Ductile Iron for Application to Rail Cast Components", Proceedings of the Fifth Asia Pacific Industrial Engineering and Management Systems Conference 2004.

Luís Magalhães, Jorge Seabra, "Teeth Surface Failures in Austempered Ductile Iron (ADI) Gears", Gears and Transmission Workshop, Paper No. XIII, p. 269-286, Faculdade de Engenharia da Universidade do Porto, Portugal, Jun. 5, 2003.

SY40AE Yoke Publication.

Y45AE Yoke Publication.

Stokes B. et al.; "Effects of Carbides on Fatigue Characteristics of Austempered Ductile Iron", Metallurgical and Materials Transactions A, 36 (2005) 977-988.

Bubenko et al.; "Fatigue Crack Propagation through Austempered Ductile Iron Microstructure"; Materials Engineering, vol. 17, 2010, No. 3, p. 15-20.

Bubenko et al.; "Fatigue Crack Propagation Within the Austempered Ductile Iron Microstructure"; Acta Metallurgica Slovaca, vol. 17, 2011, No. 1, p. 18-25.

Dundar, Sacit; "Application of Austempered Ductile Iron to Rail Wheel Sets"; Journal of Engineering Sciences 2003, 9 (3), p. 283-287.

International ADI and Simulation Conference; May 28-30, 1997.

SAIFoundry; "Austempered ductile iron production properties"; http://www.slideshare.net/SAIFoundry/austempered-ductile-iron-production-properties-applications#; Mar. 19, 2012.

* cited by examiner

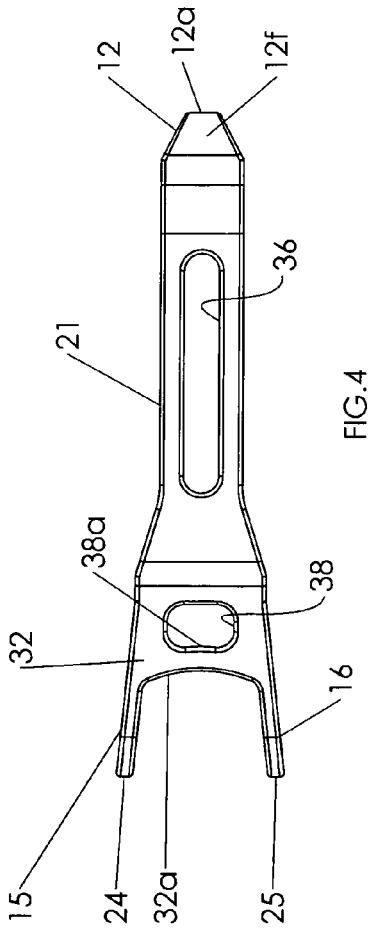


FIG.4

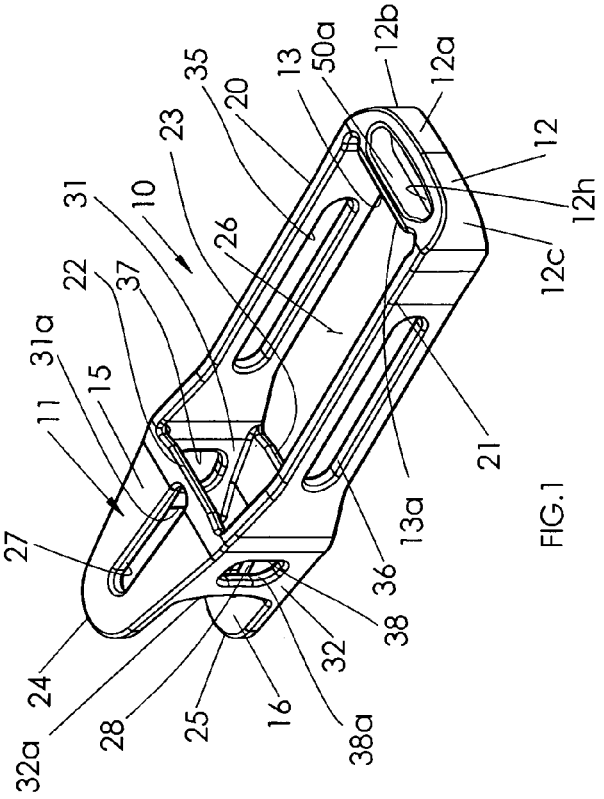


FIG.1

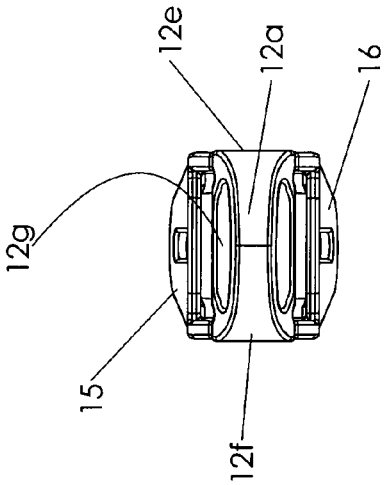


FIG.5

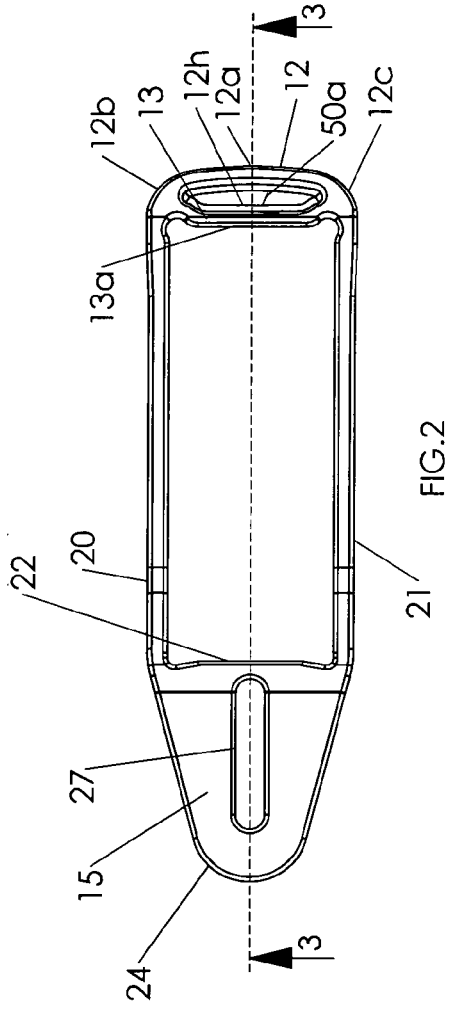

3
12b
13
12h
12a
12
50a
12c
13a
22
20
21
27
15
24
3

FIG.2

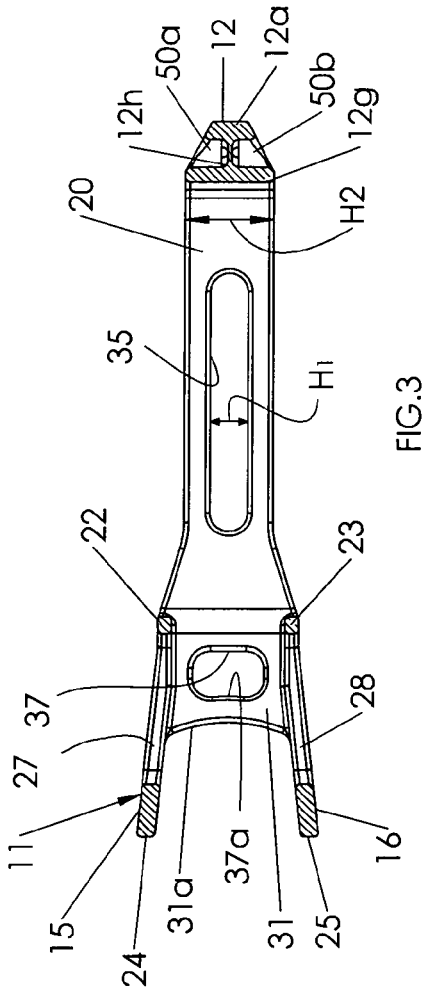

50a
12
12a
12h
50b
12g
20
H2
35
H1
22
23
37
28
27
11
16
15
24
31a
37a
31
25

FIG.3

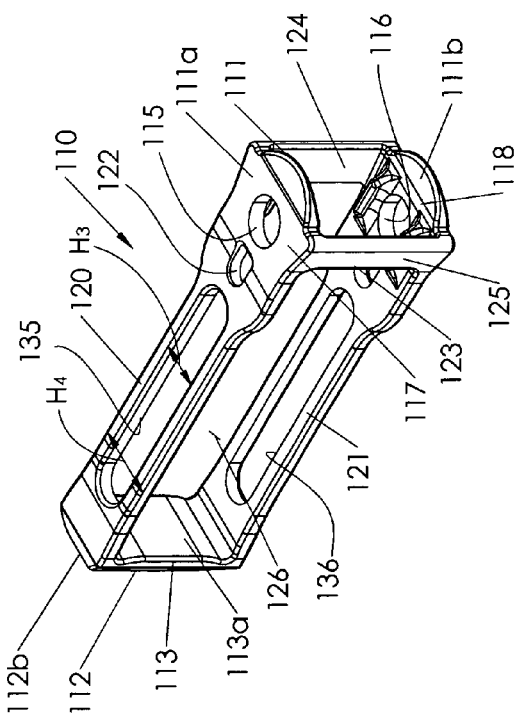

110
122
115
111a
111
124
116
111b
118
H_3
120
135
H_4
125
123
117
121
126
136
112b
112
113
113a

FIG.6

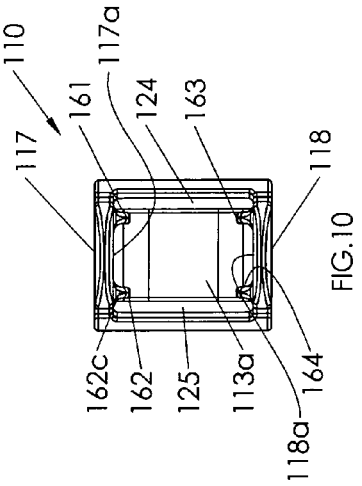

110
117
161
117a
124
163
118
162c
162
125
113a
164
118a

FIG.10

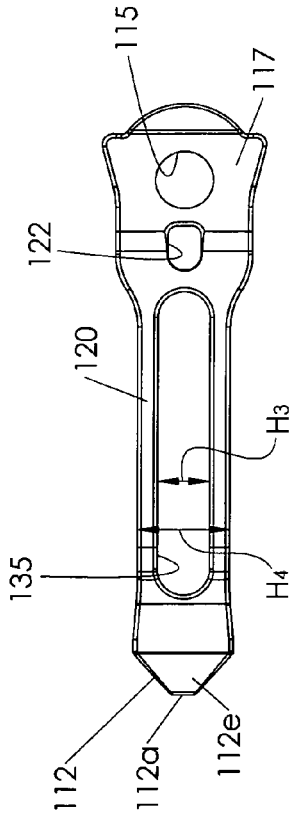


FIG.7

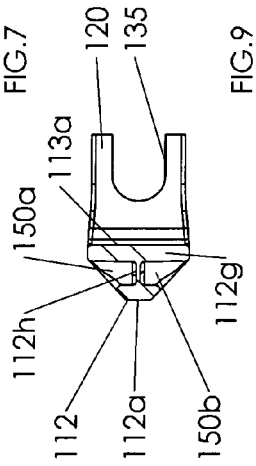


FIG.9

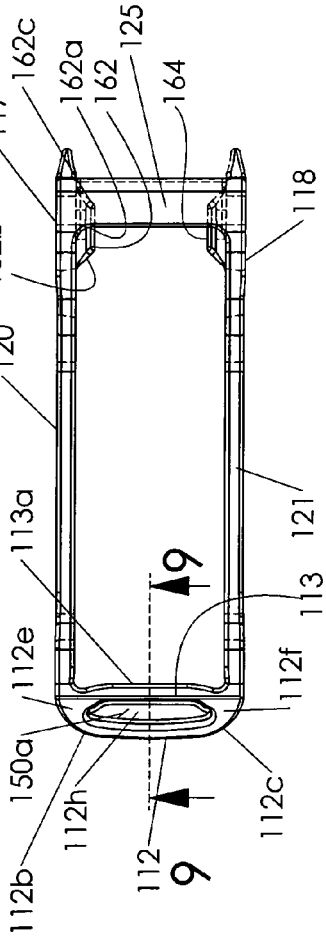


FIG.8

LIGHTWEIGHT YOKE FOR RAILWAY COUPLING

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention is directed to apparatus for coupling railway cars, and more particularly to E-type and F-type yokes that are constructed to be lighter in weight than current yokes and to provide improved wear resistance.

2. Description of Related Art

It is common practice in the railroad industry to use coupling components to secure adjacent rail cars together, in particular, freight cars. In general, two adjacent freight cars are joined by heavy shafts extending from each car, known as couplers. The couplers are installed on yokes that are mounted on the underside of the car. Railway couplers, particularly those utilized for railway freight cars or vehicles, have a coupler body which is an integral casting of a coupler head and a shank. The head of the shank may be an AAR Standard Type "E" or "F" Coupler Head. The head also carries a knuckle and includes a lock, a thrower, a pivot pin and an articulated lock assembly. Couplers generally carry a knuckle which is pivotally mounted on the coupler head and is designed to engage with another knuckle carried on an adjacent coupler or another car.

The coupler is made from a casting formed from low alloy steel. Although there are AAR standards for couplers, the length of the shank from the butt end of the coupler to the location where the shank joins the head may vary. The coupler is designed to be installed on a draft yoke of a railway vehicle. In the case of the type F coupler shank, the butt end of the coupler shank is a spherical surface and bears against the face of the front follower plate mounted within the yoke. The coupler is pivotally mounted on a yoke with a pin that joins the coupler to the vehicle's yoke. Generally, each coupler is engaged with a yoke housing a shock-absorbing element referred to as the draft gear. The type-E and type-F couplers are the standard couplers for railway freight cars. As a result of implementation of AAR standards and specifications for production of couplers, such as a type-E coupler, the standard railway car couplers are completely interchangeable, regardless of the manufacturer. In addition, adherence to a standard also promotes uniformity among manufacturers products, so that couplers from any one manufacturer are to able to be readily joined to couplers from any other domestic manufacturer. The Association of American Railroads ("AAR") has adopted standards for railway couplers, which provide specific geometry and dimensions that allow the coupler to receive standard knuckles that are pivotally carried on the coupler to couple with a knuckle on a coupler of an adjacent railway car. The knuckle must be allowed to freely operate when coupling and uncoupling railway cars. In order to determine whether a coupler meets the AAR standards, gauges may be used, which are applied to the coupler to verify that the coupler dimensions or parameters are within an allowable variation or tolerance range.

Each coupler is engaged with a yoke housing a shock-absorbing element referred to as the draft gear. Conventionally, the yoke is an elongated structure having two side sections extending from and joined by a tail portion. The side sections are also known and referred to as "straps". The side sections or straps are joined at the opposite end by a head portion where the yoke is joined to the coupler with a securing component, such as a key or pin. The yoke generally has a pocket formed by the straps and a rear wall, and a draft gear is positioned between the straps of the yoke, and between the tail portion and the head portion. The best-known yokes are the E-type and F-type. The E-type yoke is governed by AAR standards that include the AAR S-143 Standard, SY 40AE, Y40 or YS93AE, for a 24⅝ inch gear pocket, although there are some tolerances that the pocket may have, as permitted by the standards. A typical E-type yoke has straps that are 5 inches. The F-type yoke is governed by the S-149 standard and the Y45 standard. Although there are other differences between E-type and F-type yokes, a primary difference is the design and orientation of the pin or key used to join the coupler to the yoke.

Typical yokes contain apertures in the yoke head portion, which also may be known as the key slots or pin bores by which a coupler is joined to the yoke with the installation of a key or pin through the slot or bore to connect the yoke and coupler. Adjacent railcars, when coupled together and in motion, place tension on the yoke and compressive forces are transferred to bearing surfaces at opposed ends of the yoke where the draft gear is housed.

Adjacent freight cars are separated in accordance with standard specifications which includes an allowance for a specified yoke length. In accordance with applicable AAR standards, typically, E-type and F-type yokes, respectively, may have a length of 41⅛" or 37½".

SUMMARY OF THE INVENTION

Lightweight E-type and F-type yokes are provided. The yokes of the invention improve the ability of the yokes to be constructed having lighter weight, yet function to handle loads from car coupling assembly components, such as, for example, a coupler mounted on a yoke. Yokes according to the invention, in addition to being constructed lighter in weight, may also have improved wear properties, such as, for example, in regard to the engaging surfaces of the yoke.

According to one preferred embodiment, E-type and F-type yokes are provided having a tail or butt portion that includes angles or sloped walls that form a one or more cavities in the butt portion of the yoke.

According to another preferred embodiment, the butt portion of the yoke includes a supporting structure that features a transverse rib or wall that may be less than 2 inches, and preferably an inch or less, and more preferably less than ½ inch. According to some preferred embodiments, the supporting structure is even narrower, and is a transverse rib or wall that has a thickness of about ¼ inch.

It is another object of the invention to provide an improved yoke that includes lightening features of apertures in the straps or side walls of the yoke, or combinations thereof.

It is another object of the invention to provide an improved yoke that includes lightening features of apertures in the head of the yoke, and particularly in the top and bottom walls of the head.

It is another object of the invention to provide an improved yoke that may conserve material used to construct the yoke. In accordance with some preferred embodiments, yokes may be have maximum wall thicknesses of about 1¼ inches. According to some embodiments, some walls or ribs used in the construction of the yoke may have thicknesses as narrow as ¼ inch. In accordance with some preferred embodiments, the keyslot walls may be provided having a uniform or substantially uniform thickness that may be less than the thickness of the straps of the yoke. According to a preferred embodiment, a preferred thickness of the keyslot

walls may be about 1¼ inches, and according to a most preferred embodiment, may be less, and may be about 1 inch.

It is another object of the invention to provide an E-type yoke that is lighter in weight than traditional E-type yokes, yet is suitably strong and meets or exceeds AAR standards for E-type yokes.

It is another object of the invention to provide a type-F yoke that is lightweight and has improved resistance to wear.

It is another object of the invention to provide an F-type yoke that is lighter in weight than traditional F-type yokes, yet is suitably strong and meets or exceeds AAR standards for F-type yokes.

According to one preferred embodiment, it is a further object of the invention to produce an E-type yoke with opposing keyslot walls having a uniform thickness in their extension beyond the head top and bottom walls.

It is another object to accomplish the above objects by providing a yoke with one or more of the above features, including embodiments that contain one or more or combinations of one or more of the features.

BRIEF DESCRIPTION OF THE FIGURES

FIG. **1** is a perspective view of an E-type yoke according to the invention.

FIG. **2** is a side elevation view of the E-type yoke of FIG. **1**, depicted in an orientation in which the yoke is used in operation.

FIG. **3** is view looking from the bottom toward the top of a section of the yoke of FIG. **2**, taken along the section line **3-3** of FIG. **2**.

FIG. **4** is top plan view of the E-type yoke of FIG. **1**, looking overhead at the yoke.

FIG. **5** is a rear elevation view of the yoke of FIG. **1**, shown with the yoke resting on a side.

FIG. **6** is a perspective view of an F-Type yoke according to the invention.

FIG. **7** is a top plan view of the yoke of FIG. **6**.

FIG. **8** is a right side elevation view of the yoke of FIG. **6**.

FIG. **9** is a sectional view of the butt end portion of the yoke of FIG. **6**, broken away from the other portions of the yoke, and taken along the section line **9-9** of FIG. **8**.

FIG. **10** is a front elevation view of the yoke of FIG. **6**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIGS. **1-10**, exemplary embodiments of a lightweight coupler yoke **10**,**110** are shown. The yokes **10**,**110** are configured to be compatible with existing standard type couplers and knuckles to allow for use of the yokes **10**,**110** in current railway coupling applications. The yokes **10**,**110** preferably are constructed from austempered metal, as discussed herein, and preferably may be constructed having a suitable wall thicknesses to provide suitable strength to withstand force loads that a yoke would encounter during operations, including when in use on a railway vehicle. Preferred embodiments of the yokes also possess suitable strength properties to meet AAR standards or exceed them. The yokes **10**,**110** may be configured as a casting. In operation, the yokes **10**,**110** may be installed on a center sill of a railway vehicle along with a coupler and a draft gear (not shown).

According to FIGS. **1-5** an E-type yoke **10** is shown according to a preferred embodiment. The yoke **10** has a head **11** at one end thereof and a butt portion **12** at the other end thereof. Connected to the butt end portion **12** are top and bottom straps **20**,**21**, respectively, which span to extend to the yoke head **11**. A draft gear seat **13** is shown having a substantially planar surface **13***a*. The yoke head **11** includes keyslot walls **15**,**16** which, in the embodiment illustrated, are outwardly divergent from one another. The keyslot walls **15**,**16** span from the front draft gear walls **22**,**23** from which they extend forwardly, to the nose portion **24**,**25**. The draft gear pocket **26** is shown defined between the rear draft gear wall face **13***a*, the top and bottom straps **20**,**21**, respectively, and the front draft gear walls **22**,**23**. The keyslot walls **15**,**16** are provided with keyslots **27**,**28**, respectively, which oppose each other, as shown in FIGS. **2**, **3** and **5**. Each keyslot **27**,**28** preferably has a radiused configuration at each end thereof. In addition to the keyslot walls **15**,**16**, the head **11** also is shown having a first wall and a second wall, which may be referred to as a top wall **31** and a bottom wall **32**.

The yoke **10** may be configured with standard yoke contour dimensions for E-Type couplers (such as Y40 and Y41). According to preferred configurations, according to one exemplary embodiment, a yoke configured with the Y40 yoke dimension preferably has a draft gear pocket length of 24⅝ inches, and for a Y41 yoke configuration, the draft gear pocket length is 36 inch long. According to preferred embodiments, the draft gear pocket **26** preferably is sized and dimensioned in accordance with AAR specifications and standards to accommodate a draft gear and/or other components that may be installed for the coupling assembly. According to a preferred embodiment, the E-type yoke may have a preferred length of 41⅛.

According to a preferred embodiment illustrated, openings **35**,**36** are provided in the respective straps **20**,**21**. The openings **35**,**36** in the straps **20**,**21** preferably oppose each other. According to a preferred embodiment, the openings **35**,**36** are elongated to span across the straps **20**,**21**. The openings **35**,**36** are shown having radiused ends and a straight elongated portion. The straps **20**,**21** may be constructed in accordance with an AAR standard, which in some preferred embodiments is 5 inches in height. The openings **35**,**36** are preferably provided within the 5 inches of strap height. According to a preferred embodiment, the height H**1** of the openings **35**,**36** preferably are up to about one half of the strap height H**2**, as depicted according to a preferred embodiment shown in FIG. **3**. According to one preferred embodiment, the strap height H**2** is 5 inches and the opening height H**1** is 2½ inches. According to one embodiment, the draft gear pocket **26** may be 25 inches (measured from a plane of the rear surface **13***a* to a plane of the draft gear pocket front walls **22**,**23**). According to one preferred embodiment, the openings **35**,**36** are provided at a central location of the straps **20**,**21**, relative to the strap height. According to one embodiment, the openings preferably are provided to be located within about 1.5 inches from the edge of a strap wall.

Referring to FIGS. **1**, **3** and **4**, the top wall **31** and bottom wall **32** of the head portion or head **11** preferably have wall openings **37**,**38**, respectively, disposed therein. According to a preferred embodiment, the wall openings **37**,**38** are provided to oppose each other, and preferably, the openings **37**,**38** are centrally located in the top and bottom walls **31**,**32**, respectively. According to a preferred embodiment, the top wall **31** and bottom wall **32** have a curved or radiused edges **31***a*,**32***a*, respectively, which are provided at the front wall end. According to a preferred embodiment, the openings **37**,**38** preferably are provided with a forward portion **37***a*,**38***a*, which is radiused or curved. According to some

preferred embodiments, the radiused or curved forward portion **37***a*,**38***a* of the respective top and bottom wall openings **37**,**38** has a profile corresponding with the radius or curve of the top and bottom front wall edges **31***a*,**32***a*. In a preferred embodiment, the wall openings **37**,**38** have radiused or curved corners. As illustrated the top and bottom walls **31**,**32**, respectively, support the yoke **10** and the keyslot walls **15**,**16** connecting to the respective top and bottom walls **31**,**32**.

According to a preferred embodiment, the thickness of the yoke walls preferably may be constructed to be from about 1¼ inches to about ¼ inch. For example, the thickness of the walls forming the straps **20**,**21** may be from about 1 inch to 1¼ inch, with a preferred thickness of about 1⅛ inch. According to some embodiments, the top and bottom walls **31**,**32** of the head portion **11** may have a wall thickness that is similar to the walls of the straps **20**,**21**. Preferably the thickness of the keyslot walls **15**,**16** may be provided to be about 1¼ inches or less, and according to some preferred embodiments, the thickness of the keyslot walls **15**,**16** is about 1 inch. According to a preferred embodiment, the wall thicknesses of the key slot walls **15**,**16**, the straps **20**,**21** and top and bottom walls **31**,**32** may be from about 1 inch to 1¼ inches, wherein each wall or strap pair may have a thickness within this range, which may be a different thickness than the other wall pair or strap pair. According to a preferred embodiment, each strap **20**,**21** preferably may have a uniform thickness along its length between joining locations (which is shown joining with the butt end **12** at one end thereof, where a radiused fillet may be provided (FIG. **2**), and joining with the head **11** at the other end thereof, which also may have a radiused fillet at the head portion **11**.

According to a preferred embodiment, as illustrated, the yoke **10** has a butt end portion **12** disposed opposite the head portion **11**. The butt end portion **12** is shown having radiused or curved edges **12***b*,**12***c*, and a pair of pockets **50***a*,**50***b* (see FIG. **3**) provided in the butt end portion **12**. Referring to FIG. **5**, the butt end portion **12** is shown having tapered side wall portions **12***e*,**12***f* which taper inwardly toward the center of the butt end portion **12**. The butt end portion **12** is shown with a rear wall portion **12***a* formed by the narrowing of the converging side wall portions **12***e*,**12***f*. Referring to FIG. **3**, the butt end portion **12** is shown having an inner wall portion **12***g* which preferably is connected with the rear wall portion **12***a*. According to a preferred embodiment, the inner wall portion **12***g* connects with the rear wall portion **12***a* by a connecting structure, which in the preferred embodiment illustrated, is shown as a rib or wall **12***h*. The connecting rib or wall **12***h* preferably is transversely disposed and is provided at the mid level of the height of the butt end portion **12**, such as, for example, the height of the inner wall **12***g*. The inner wall **12***g* according to some preferred embodiments may be formed from the wall that forms the draft gear seat **13** and may be coextensive with it, or formed such that the draft gear surface **13***a* is on one side of the wall and the rear surface of the draft gear seat wall faces into the cavities or pockets **50***a*,**50***b*.

Referring to FIGS. **6-10**, according to one embodiment, an F-type coupler yoke **110** is shown according to a preferred embodiment. The coupler yoke in the F-type yoke configuration, illustrated as the yoke **110**, is generally oriented vertically when in use, as depicted in the view of FIG. **6**, where the pin bores **115**,**116** are shown located vertically to receive a connecting member, such as a pin (not shown) to connect with a component of a coupling assembly (e.g., a coupler). The yoke **110** has a head or head portion **111** at one end thereof and a butt portion **112** at the other end thereof. The head portion **111** preferably includes an upper head portion **111***a* and lower head portion **111***b*. Connected to the butt end portion **112** are top and bottom straps **120**,**121**, respectively, which span to extend to the yoke head **111**. A draft gear seat **113** is shown having a substantially planar surface **113***a*. The yoke head **111** includes pin bores **115**,**116** which are provided in the respective top and bottom walls **117**,**118** of the head **111**. According to a preferred embodiment illustrated, the top and bottom walls **117**,**118** may be outwardly divergent from one another. Preferably, an upper window **122** and lower window **123** are formed in the respective top and bottom walls **117**,**118** through which observation of the draft gear (not shown) may be made when the yoke is installed in an assembly with other coupling components. A front supporting structure, shown including a pair of side walls **124**,**125** is provided, and connects the upper front wall portion or wall **117** with the lower front wall portion or wall **118**. A pocket **126** is shown provided between the draft wall surface **113***a* and the yoke head portion **111**.

According to a preferred embodiment illustrated, strap openings **135**,**136** are provided in the respective straps **120**,**121**. The strap openings **135**,**136** preferably oppose each other. According to a preferred embodiment, the strap openings **135**,**136** are elongated to span across the straps **120**,**121**. The strap openings **135**,**136** are shown having radiused ends and a straight elongated portion. The straps **120**,**121** may be constructed in accordance with an AAR standard, which in some preferred embodiments is 5¾ inches in height (as viewed in FIG. **7**, where a strap height H**4** is represented). The strap openings **135**,**136** are preferably provided within the 5¾ inches of strap height dimension H**4**. According to a preferred embodiment, the height H**3** of a strap opening **135**,**136** preferably is up to about one half of the strap height H**4**, as depicted according to a preferred embodiment shown in FIG. **7**, showing the strap **135**. According to one embodiment, yoke **110** may have an overall length of 37½ inches, with the draft gear pocket **126** having a length of 24⅝ inches (measured from the rear surface **113***a* to a point $4^{17}/_{32}$ inches behind the center point of the pin or pin bore **115**,**116**). According to a preferred embodiment, the rear surface **113***a* to the center of a pin bore **115**,**116** is $29^{5}/_{32}$ inches. According to one preferred embodiment, the strap openings **135**,**136** are provided at a location between the butt end portion **112** and the head portion **111**. According to one embodiment, the openings preferably are provided to be located within about 1 inch to 1½ inches, and preferably about 1¼ inches to 1⅜ inches from the edge of a strap wall. According to a preferred embodiment, the straps **120**,**121** may increase in width at the locations near each of the ends of the respective straps **120**,**121**, including, for example, at the strap locations where the front and rear of the openings **135**,**136** begin or end.

According to a preferred embodiment, the thickness of the walls of the yoke **110** preferably may be constructed to have thicknesses between about 1¼ inches to about ¼ inch. For example, the thickness of the walls forming the straps **120**,**121** may be from about 1 inch to 1¼ inches, with a preferred thickness of about 1⅛ inches. According to some embodiments, the top and bottom walls **117**,**118** of the head portion **111** may have a wall thickness that is similar to the walls of the straps **120**,**121**. The top and bottom walls **117**,**118** may comprise extensions of the respective straps **120**,**121** and have similar thicknesses or, alternatively, have different thicknesses than the respective straps **120**,**121**. Accordingly, the pin bores **115**,**116** preferably have a depth corresponding with the thickness of the respective top and

bottom wall **115**,**116**, or respective top or bottom strap **120**,**121**. According to a preferred embodiment a positioning feature is provided at the yoke head portion **111**. Referring to FIG. **10**, the positioning feature is shown in accordance with a preferred construction as a plurality of positioning tabs **161**,**162** provided on the inner surface **117***a* of the top wall portion **117**, and positioning tabs **163**,**164** provided on the inner surface **118***a* of the lower wall **118**. The positioning feature facilitates even loading to control and distribute loads, for example, from a coupler shank. The positioning tabs **161**,**162**,**163**,**164** preferably comprise wear surfaces and preferably are constructed from the same composition as the other portions of the yoke **110**. Preferably the positioning tabs, such as the upper tabs **161**,**162** and lower tabs **163**,**164**, are provided in opposing relation to each other so that the upper tabs **161**,**162** face the lower tabs **163**,**164**, with each upper tab **162**,**162**, facing a respective lower tab **163**,**164**. As shown in FIG. **8**, the tab **162** has a generally flat or substantially flat inner surface portion **162***a* and has tapered sides **162***b*,**162***c*. Preferably, the other tabs **161**,**163**,**164** also are constructed having a flat or substantially flat inner surface portion and tapered sides. The tabs **161**,**162**,**163**,**164** narrow the opening provided at the head **111** of the yoke **110**. According to one preferred embodiment, the tab pairs **161**, **162** and **163**,**164** are disposed proximate the respective pin bore openings **115**,**116**, with each tab of a pair being provided on an adjacent side of a respective pin bore **115**,**116**.

According to a preferred embodiment, as illustrated, the yoke **110** has a butt end portion **112** disposed opposite the head portion **111**. The butt portion **112** is shown having radiused or curved edges **112***b*,**112***c*, and pockets **150***a*,**150***b* provided in the butt end portion **112**. According to preferred embodiments, the pocket arrangement includes a first pocket **150***a* and second pocket **150***b*. Referring to FIGS. **7**, **8** and **9**, the butt end portion **112** is shown having tapered side wall portions **112***e*,**112***f* which taper inwardly toward the center of the butt end portion **112** (similar to the walls **12***e*,**12***f* of the butt end portion **12** shown in FIG. **5**, in connection with the yoke **10**). The butt end portion **112** is shown with a rear wall portion **112***a* formed by the narrowing of the converging side wall portions **112***e*,**112***f*. Referring to FIG. **9**, the butt end portion **112** is shown having an inner wall portion **112***g* which preferably is connected with the rear wall portion **112***a*. According to a preferred embodiment, the inner wall portion **112***g* connects with the rear wall portion **112***a* by a connecting structure, which in the preferred embodiment illustrated, is shown as a rib or wall **112***h*. The connecting rib or wall **112***h* preferably is transversely disposed and is provided at the mid level of the height of the butt end portion **112**, such as, for example, the height of the inner wall **112***g*. The inner wall **112***g* according to some preferred embodiments may be formed from or be part of the wall that forms the draft gear seat **113** and may be coextensive with it, or formed such that the draft gear surface **113***a* is on one side of the wall and the rear surface thereof faces into the cavities or pockets **150***a*,**150***b*.

According to a preferred embodiment, the front portion of the straps **120**,**121** may be constructed to slightly taper inwardly at the head portion **111**. According to a preferred embodiment, the inwardly taper of the straps **120**,**121** preferably is after the front of the openings **135**,**136**, and the straps **120**,**121** and head walls **117**,**118** that join with straps **120**,**121**, respectively, also may have an inward taper. According to a preferred embodiment, a further inward taper of the front portions of the walls **117**,**118** may be provided, and the inward taper may include a portion of converging wall thickness in the front of each wall **117**,**118**, preferably at each front flange **117***b*,**118***b*.

According to some embodiments, the yoke **110** may be configured with standard yoke contour dimensions for F-Type yokes. According to preferred configurations, a yoke configured with the S-149 yoke dimension preferably has a draft gear pocket length of 24⅝ inches and a length of 37½ inches. The spacing between the straps **120**,**121**, as depicted in FIG. **8**, preferably, meets or exceeds the AAR standards (including any allowable tolerances) so the pocket **126** formed between the straps **120**,**121** may accommodate coupling components (e.g., a draft gear). According to some preferred embodiments, the yoke height, as shown by reference to the orientation in FIG. **8**, may have a height of about 11½ inches. The yoke **110** preferably may be configured with dimensions that meet the AAR specifications for F-type yokes including with any permitted tolerances, and, may exceed the specifications.

According to a preferred embodiment, the yokes **10**,**110** are constructed from an austempered metal, and more preferably, from austempered ductile iron (ADI). Although other austempered metals may be used, and other grades of ADI, according to a preferred embodiment, yokes may be constructed from Grade 3 ADI. According to a preferred embodiment, the ADI may be Grade 3 ADI in accordance with ASTM A897/A897M for ADI castings. According to some preferred embodiments, yokes **10**,**110** may have properties that meet or exceed the specifications for Grade 3 ADI.

The yokes **10**,**110** preferably join with a coupler that carries a pivotally connected knuckle movable between open and closed positions. According to preferred embodiments, the yokes **10**,**110** are constructed from an austempered metal, and more preferably austempered ductile iron. As discussed herein, according to preferred embodiments, the yokes **10**,**110** are constructed from ductile iron that is austempered (austempered ductile iron or "ADI"). According to a preferred embodiment, the yokes **10**,**110** may be constructed from a material that is suitably strong and, according to preferred embodiments, may be used to construct a yoke **10**,**110** which meets or exceeds AAR standards. According to come embodiments, the yokes **10**,**110** may be constructed from Grade E steel or ductile iron, and according to some preferred embodiments, the yokes **10**,**110** may be constructed from an austempered metal, such as for example, austempered steel, austempered alloy steel, as well as other austempered metals, and austempered metal alloys. According to a preferred embodiment, the yokes **10**,**110** are constructed from austempered ductile iron. The ductile iron from which the yoke **10**,**110** is formed, may include austempered ductile iron that comprises ductile iron alloyed with one or more metals selected from the group consisting of nickel, molybdenum, manganese, copper and mixtures thereof. According to preferred embodiments, the metal, such as, for example, according to a preferred embodiment, ductile iron used to produce the yoke **10**,**110**, may be treated by a treatment process, and preferably a process to strengthen the material, and to provide a suitable microstructure in the formed yoke **10**,**110**. According to preferred embodiments, the treatment process preferably involves an austenitizing process, by which the formed yoke **10**,**110** is an austempered material, and more preferably, austempered ductile iron (ADI). For example, the forming of the yoke **10**,**110** may involve applying a suitable austenitizing process to the formed ductile iron yoke, (e.g., a casting, forging, machining or other method of forming the yoke). One preferred method involves heating the yoke casting in a heat extraction composition, such as, for example, a molten salt

bath, to austenitizing temperature; and holding the bath at an austenitizing temperature so as to dissolve carbon in austenite, followed by quenching (preferably rapidly done) to avoid pearlite formation, and holding the yoke at an austempering temperature in the molten salt bath. The isothermal transformation to ausferrite preferably takes place to provide an austempered ductile iron yoke **10**,**110**. According to alternate embodiments, austempered ductile iron (ADI) may include ductile iron alloyed with one or more metals, such as, for example, nickel, molybdenum, manganese, copper and mixtures thereof.

The ADI or ductile iron is austempered to obtain tensile strength, yield, and elongation properties for the inventive yokes which are suitable to meet or exceed the AAR standards for yokes utilized in coupling systems, including the current standard set forth by the American Association of Railroads (AAR) in AAR Manual of Standards and Recommended Practices, such as current standard M-211, M-205, M-220 NDT and Rule 88 of the AAR Office Manual, the complete contents of which are herein incorporated by reference. Alternatively, according to some alternate embodiments, austempered steel, such as, austempered alloy steel, as well as other austempered metals, such as, for example, austempered metal alloys, may be used to construct the yokes **10**,**110**.

According to preferred embodiments, the yokes **10**,**110** may be constructed having wall thicknesses that are reduced compared to current existing yokes. The yokes **10** and **110** shown are preferred embodiments, and other configurations, preferably, yoke constructions meeting the standard geometries of AAR coupler yoke standards may be provided and produced in accordance with the present invention, including constructing the yoke to be lighter in weight and/or have thinner walls or wall portions, having openings in the straps and walls, as well as constructing the yokes from austempered metal, and more preferably Grade 3 ADI. Preferred thicknesses for the yoke walls according to preferred embodiments, are from about ¼ inch to about 1¼ inches.

Lightweight yokes according to the invention preferably are compatible with coupling and usage of the prior yokes for connection with and use with prior and existing standard AAR couplers, draft gears, blocks and other standard coupling assembly components. The lightweight yokes of the invention provide a lightweight alternative that may be used in place of prior yokes, wherever the prior yokes have been used or are called for. In addition, although references are made to some preferred dimensions corresponding with AAR standards, the dimensions preferably include tolerances provides by or permitted by the standards. According to alternate embodiments, the yokes may be dimensioned to meet one or more alternative standards.

According to preferred embodiments, the coupler yokes may be made from a casting and with the use of cores.

It is intended that the foregoing detailed description be regarded as illustrative rather than limiting, and that it be understood that it is the following claims, including all equivalents, that are intended to define the spirit and scope of this invention. Numerous other changes, substitutions, variations, alterations and modifications may be ascertained by those skilled in the art and it is intended that the present invention encompass all such changes, substitutions, variations, alterations and modifications as falling within the spirit and scope of the appended claims.

What is claimed is:

1. A railway vehicle coupler yoke, comprising:

(a) a head portion at one end having a first wall and a second wall defining a front opening therebetween;

(b) a rear portion;

(c) two elongated strap portions, the strap portions spanning from the head portion to the rear portion, said rear portion joining said strap portions; and

(d) a central pocket with two open sides formed by said two elongated strap portions;

(e) wherein each strap portion has at least one opening therein,

(f) wherein said at least one opening in each said strap portion is disposed at a location between said head portion and said rear portion; and

(g) wherein each strap portion includes at least a bordering portion that borders the central pocket, and where the opening in each strap portion is located in the strap bordering portion.

2. The railway vehicle coupler yoke of claim **1**, wherein each said opening provided in one strap portion opposes the opening provided in the other strap portion.

3. The railway vehicle coupler yoke of claim **1**, wherein said yoke is constructed from austempered metal.

4. The railway vehicle coupler yoke of claim **3**, wherein said austempered metal is austempered ductile iron.

5. The railway vehicle coupler yoke of claim **4**, wherein said austempered ductile iron comprises ductile iron alloyed with one or more metals selected from the group consisting of nickel, molybdenum, manganese, copper and mixtures thereof.

6. The railway vehicle coupler yoke of claim **4**, wherein said coupler yoke is configured as an E-type coupler yoke.

7. The railway vehicle coupler yoke of claim **6**, wherein said first wall and said second wall defining said front opening comprise keyslot walls, and wherein the yoke head portion includes a top wall and a bottom wall disposed in opposing relation to each other, wherein said top wall is joined at one side thereof with one of said elongated strap portions, and wherein said bottom wall is joined at one side thereof with the other of said elongated strap portions, wherein the end of said top wall and said bottom wall opposite the end thereof joined with a said strap each has an edge forming a front edge of said yoke; wherein an opening is provided in said top wall, wherein an opening is provided in said bottom wall, and wherein said top and bottom wall openings are oppositely disposed.

8. The railway vehicle coupler yoke of claim **7**, wherein said edge of said top wall and said edge of said bottom wall are arcuately disposed, and wherein each of said head top wall and head bottom wall openings has at least one edge thereof that is arcuately shaped and corresponds with the profile of the arcuately shaped head top wall edge and arcuately shaped head bottom wall edge, and wherein each said head top wall and head bottom wall opening is spaced apart from its respective top wall edge and bottom wall edge.

9. The railway vehicle coupler yoke of claim **7**, wherein a draft gear seat wall is provided at the rear of said central pocket, wherein said rear portion comprises a butt end having a tapered wall portion joining with each strap, wherein said tapered wall portions converge as they extend rearwardly to the back end of the yoke and form a rear wall of the yoke, wherein a cavity is formed by said tapered wall portions and said draft gear seat wall, and wherein a connecting structure transversely spans between said draft gear seat wall and said yoke rear wall.

10. The railway vehicle coupler yoke of claim **4**, wherein said coupler yoke is configured as an F-type coupler yoke.

11. The railway vehicle coupler yoke of claim **10**, wherein a draft gear seat wall is provided at the rear of said central pocket, wherein said rear portion comprises a butt end

having a tapered wall portion on each side thereof joining with each strap, wherein said tapered wall portions converge as they extend rearwardly to the back end of the yoke and form a rear wall of the yoke, wherein a cavity is formed by said tapered wall portions and said draft gear seat wall, and wherein a connecting structure transversely spans between said draft gear seat wall and said yoke rear wall.

12. The railway vehicle coupler yoke of claim **11**, said first wall having an interior and an exterior, said second wall having an interior and an exterior, wherein at least one positioning tab is disposed on the interior of each of said first wall and said second wall, said at least one positioning tab on said first wall opposing the at least one positioning tab on said second wall, said positioning tabs extending from each said respective first wall interior and second wall interior into the front opening.

13. The railway vehicle coupler yoke of claim **12**, including a first pin bore disposed in the first wall and a second pin bore disposed in the second wall, said pin bores opposing one another, and wherein said positioning tabs comprise a first pair of positioning tabs disposed on the first wall interior on opposite sides of said first pin bore and a second pair of positioning tabs disposed on the second wall interior on opposite sides of said second pin bore.

14. The railway vehicle coupler yoke of claim **12**, including a first pin bore disposed in the first wall and a second pin bore disposed in the second wall, said pin bores opposing one another, and wherein said positioning tabs comprise a first pair of positioning tabs disposed on opposite sides of said first pin bore and a second pair of positioning tabs disposed on opposite sides of said second pin bore.

15. The railway vehicle coupler yoke of claim **10**, wherein said head portion first wall is continuous with said top strap portion and forms an extension thereof, wherein said head portion second wall is continuous with said bottom strap portion and forms an extension thereof, wherein a pair of vertical walls join said first wall and said second wall at each side of said front opening, said first wall having an interior and an exterior, said second wall having an interior and an exterior, wherein at least one positioning tab is disposed on the interior of said first wall, wherein at least one positioning tab is disposed on the interior of said second wall, said at least one positioning tab on said first wall opposing said at least one positioning tab on said second wall, said positioning tabs extending from each respective first wall interior and second wall interior into the front opening.

16. The railway vehicle coupler yoke of claim **1**, wherein said elongated strap portions have thicknesses from 1.0 to 1.25 inches.

17. The railway vehicle coupler yoke of claim **1**, wherein the central pocket has a front and a rear, wherein a draft gear seat rear wall is located at the rear of the central pocket, and wherein a front draft gear wall is located at the front of the central pocket, wherein said openings are disposed on opposite sides of the central pocket formed by said strap portions, and wherein said openings are disposed in the portion of the strap portion that is located between the front draft gear wall and the rear draft gear wall.

18. The railway vehicle coupler yoke of claim **17**, wherein at least a portion of each strap portion is located between the front draft gear wall and the rear draft gear wall.

19. The railway vehicle coupler yoke of claim **1**,

wherein said coupler yoke is configured as an F-type coupler yoke;

wherein said head portion first wall is continuous with said top strap portion and forms an extension thereof, wherein said head portion second wall is continuous with said bottom strap portion and forms an extension thereof, wherein a pair of vertical walls join said first wall and said second wall at each side of said front opening;

wherein said head portion first wall is wider than said elongated top strap portion, and wherein said head portion second wall is wider than said elongated bottom strap portion,

and wherein the opening in the top strap portion is located in an area of said top strap portion that is narrower than said head portion first wall, and wherein the opening in the bottom strap portion is located in an area of said bottom strap portion that is narrower than said head portion second wall.

20. A railway vehicle coupler yoke, comprising:

(a) a head portion at one end having a first wall and a second wall defining a front opening therebetween;

(b) a rear portion;

(c) two elongated strap portions, the strap portions spanning from the head portion to the rear portion, said rear portion joining said strap portions;

(d) a central pocket with two open sides formed by said two elongated strap portions;

(e) wherein each strap portion has at least one opening therein, and wherein each said opening provided in one strap portion opposes the opening provided in the other strap portion;

(f) wherein said yoke is constructed from austempered ductile iron;

(g) wherein said coupler yoke is configured as an E-type coupler yoke;

(h) wherein said first wall and said second wall defining said front opening comprise keyslot walls,

(i) wherein the yoke head portion includes a top wall and a bottom wall disposed in opposing relation to each other, wherein said top wall is joined at one side thereof with one of said elongated strap portions, wherein said bottom wall is joined at one side thereof with the other of said elongated strap portions, wherein the end of said top wall and said bottom wall opposite the end thereof joined with a said strap portion each has an edge forming a front edge of said yoke; wherein an opening is provided in said top wall, wherein an opening is provided in said bottom wall, and wherein said top and bottom wall openings are oppositely disposed;

(j) wherein said edge of said top wall and said edge of said bottom wall are arcuately disposed, and wherein each of said openings has at least one edge thereof that is arcuately shaped and corresponds with the profile of the arcuately shaped wall edge, and wherein each said opening is spaced apart from one of said top wall edge and said bottom wall edge;

(k) wherein a draft gear seat wall is provided at the rear of said central pocket, wherein said rear portion comprises a butt end having a tapered wall portion on each side thereof joining with each strap, wherein said tapered wall portions converge as they extend rearwardly to the back end of the yoke and form a rear wall of the yoke, wherein a cavity is formed by said tapered wall portions and said draft gear seat wall, and wherein a connecting structure transversely spans between said draft gear seat wall and said yoke rear wall;

(l) wherein a front draft gear wall is provided at the front of said central pocket;

(m) wherein each said opening in the strap portion is provided at a location of the strap portion between the draft gear seat wall and the front draft gear wall; and

(n) wherein said elongated strap portions have thicknesses from 1.0 to 1.25 inches.

21. A railway vehicle coupler yoke, comprising:

(a) a head portion at one end having a first wall and a second wall defining a front opening therebetween;

(b) a rear portion;

(c) two elongated strap portions, the strap portions spanning from the head portion to the rear portion, said rear portion joining said strap portions; and

(d) a central pocket with two open sides formed by said two elongated strap portions;

(e) wherein each strap portion has at least one opening therein, and wherein each said opening provided in one strap portion opposes the opening provided in the other strap portion;

(f) wherein said yoke is constructed from austempered ductile iron;

(g) wherein said yoke is configured as an F-type coupler yoke;

(h) wherein a draft gear seat wall is provided at the rear of said central pocket, wherein said rear portion comprises a butt end having a tapered wall portion on each side thereof joining with each strap, wherein said tapered wall portions converge as they extend rearwardly to the back end of the yoke and form a rear wall of the yoke, wherein a cavity is formed by said tapered wall portions and said draft gear seat wall, and wherein a connecting structure transversely spans between said draft gear seat wall and said yoke rear wall dividing said cavity into a first cavity and a second cavity;

(i) wherein said head portion first wall is continuous with said top strap portion and forms an extension thereof, wherein said head portion second wall is continuous with said bottom strap portion and forms an extension thereof, wherein a pair of vertical walls are spaced apart and located on opposite sides of said front opening and join said first wall and said second wall at each side of said front opening;

(j) wherein each said elongated strap portion has a narrow portion, and wherein said strap portion opening is provided in said strap narrow portion;

(k) wherein said first wall has an interior and an exterior, wherein said second wall has an interior and an exterior, wherein at least one positioning tab is disposed on the interior of each of said first wall and said second wall, said at least one positioning tab on said first wall opposing the at least one positioning tab on said second wall, said positioning tabs extending from each said respective first wall interior and second wall interior into the front opening;

(l) a first pin bore disposed in said first wall and a second pin bore disposed in said second wall, said pin bores opposing one another, and wherein said positioning tabs comprise a first pair of positioning tabs disposed on the first wall interior on opposite sides of said first pin bore and a second pair of positioning tabs disposed on the second wall interior on opposite sides of said second pin bore; and

(m) wherein said elongated strap portions have thicknesses from 1.0 to 1.25 inches.

22. The railway vehicle coupler yoke of claim **21**, wherein the openings in said strap portions are provided at a location of each strap portion that is between said positioning tabs and said draft gear seat wall.

23. A railway vehicle coupler yoke, comprising:

(a) a head portion at one end having a first wall and a second wall defining a front opening therebetween;

(b) a rear portion;

(c) two elongated strap portions, the strap portions spanning from the head portion to the rear portion, said rear portion joining said strap portions; and

(d) a central pocket with two open sides formed by said two elongated strap portions;

(e) wherein each strap portion has at least two openings therein, and wherein each said opening provided in one strap portion opposes at least one of the openings provided in the other strap portion; and

(f) wherein at least one opening in each strap portion is provided at a location of the strap portion that is spaced rearwardly from the head portion.

24. The railway vehicle coupler yoke of claim **23**, wherein at least one of said at least two strap openings of each strap portion is provided in said head portion of the strap portion.

25. A railway vehicle coupler yoke, comprising:

(a) a head portion at one end having a first wall and a second wall defining a front opening therebetween;

(b) a rear portion;

(c) two elongated strap portions, the strap portions spanning from the head portion to the rear portion, said rear portion joining said strap portions; and

(d) a central pocket with two open sides formed by said two elongated strap portions;

(e) a positioning tab provided on each of said first wall and said second wall;

(f) wherein each strap portion has at least one opening therein that is provided in said strap portion at a location between said rear portion and said positioning tabs; and

(g) wherein at least a portion of each said at least one strap opening is located in a narrow elongated portion of said strap portion that spans substantially the length of the central pocket.

26. A railway vehicle coupler yoke, comprising:

(a) a head portion at one end having a first wall and a second wall defining a front opening therebetween;

(b) a rear portion;

(c) two elongated strap portions, the strap portions spanning from the head portion to the rear portion, said rear portion joining said strap portions; and

(d) a central pocket with two open sides formed by said two elongated strap portions;

(e) wherein each elongated strap portion has at least one opening therein;

(f) wherein each elongated strap portion comprises a narrow portion, and wherein each narrow portion has an opposing pair of bordering portions that span along the central pocket and which border the opening in each strap portion;

(g) wherein said coupler yoke is configured as an F-type coupler yoke; and

(h) wherein said head portion first wall is continuous with said top strap portion and forms an extension thereof, wherein said head portion second wall is continuous with said bottom strap portion and forms an extension thereof, wherein a pair of vertical walls join said first wall and said second wall at each side of said front opening, said first wall having an interior and an exterior, said second wall having an interior and an exterior, wherein at least one positioning tab is disposed on the interior of said first wall, wherein at least one positioning tab is disposed on the interior of said second wall, said at least one positioning tab on said first wall opposing said at least one positioning tab on said second wall, said positioning tabs extending from

each respective first wall interior and second wall interior into the front opening.

27. The railway vehicle coupler yoke of claim **26**, wherein the yoke is constructed from austempered ductile iron.

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